
HANDWRITING EXAMINATION IN FORENSIC SCIENCE

Anupama U 1, Dr. DollyMahna 2

1M.Sc. Student, Department of Forensic Science, Chandigarh University, Gharuan, India
Email ID: anupamaanu26878@gmail.com

2Assistant Professor, Department of Forensic Science, Chandigarh University, Gharuan, India

ABSTRACT

Handwriting analysis is an important instrument in forensic science that is used to identify and authenticate documents, examine criminal cases, and determine the trustworthiness of written evidence. It is a key subfield of forensic science that plays a distinctive and long – lasting role in document investigation and authentication. For decades, handwriting analysis has been critical in resolving criminal cases and providing light on historical riddles. Although forensic analysis of digital data has gained popularity as technology has advanced, the examination of handwritten papers remains indispensable, providing its value in current forensic investigation. This review paper examines the ideas, methodologies, and applications of handwriting analysis in the field of forensic science in depth. It investigates the historical development of handwriting analysis. The scientific foundation of the discipline, handwriting comparison procedures, and the obstacles that modern forensic document inspection faces. This study also covers the legal elements of handwriting analysis, its limitations, and the future possibilities of this important forensic profession.

Keywords: Handwriting analyzing, Quantitative analysis, Class Characteristics, Question document, Legal proceedings, Quality Assurance.

INTRODUCTION

Any written format that includes writings or symbols that are visible without necessarily conveying their content is considered handwriting. Analyzing handwriting by contrasting or differentiating specific handwriting traits is one method of document examination. The information is further verified by a forensic examiner before being used as evidence to prove a person's guilt or innocence. (1) An individual's age and neurological condition might have an impact on their handwriting, which is the result of their body's neuromuscular coordination. (2) Everybody writes in a different way. It often modifies the range variation, but age also evaluates the deviation outside the range of natural variation. Numerous studies demonstrate that handwriting varies gradually over time. (3)– (4) Penmanship is a deliberate act, but writing every word and letter repeatedly almost becomes instinctive. The writer focuses less on the writing process itself and more on the message they are trying to convey. (6) It entails analyzing handwritten texts, signatures, and other writings to ascertain the authorship, provenance, and authenticity of each. This field is predicated on the knowledge that, like fingerprints, each person's handwriting displays distinct personal traits. Numerous analytical factors are taken into account when conducting handwriting studies, including pen pressure, line quality, word and letter spacing, alignment, and more. These variables could aid in illuminating the mode, situation, and a criminal atmosphere. Many handwriting evidences have recently been discovered at crime scenes on odd surfaces. This could make the inquiry more difficult because the victim's normal handwriting could be distorted or deformed by strange surfaces. Due to the changes in natural handwriting, more advanced analytical methods and

thorough research were needed. The current evaluation includes the results of forensic investigations, the success rate of such analysis, and the use of various writing equipment on handwriting on irregular and atypical surfaces. The purpose of section (7) is to examine how ageing affects individual traits since, as a person ages, their behaviors and hand and finger sizes vary periodically. Other changes that coincide with ageing include reduced hand shaking as people age due to vision problems also happens, which has an impact on handwriting. In our research, we try to understand how age differences in people's handwriting affect handwriting in different ways or preserve some of the characteristics of their handwriting from their adult years.

HANDWRITING AND PERSONALITY

The neuromuscular activity of handwriting aids professionals in deciphering a person's personality from their handwriting. The relationship between a person's signature and handwritten work depends on their class and personal traits. Since penmanship is a process of learning, the comparison's visual appearance can alter from childhood to youth without affecting its differentiation.

Features of handwritten texts

CHARACTERISTICS OF HANDWRITINGS

The following are some traits of handwritings:

Writing qualities that are typical of a certain class of writers or group of writers are known as class characteristics.

Unique qualities - Unique qualities are unique to each individual and are developed throughout time by them.

CLASS CHARACTERISTICS OF HANDWRITING ARE:

A person's handwriting can disclose details about their personality, feelings, and even some physical and neurological traits. The following traits are frequently connected to handwriting analysis:

Size: A writer's desire for attention can be inferred by the size of their letters. Small letters could imply introversion, whereas large letters might represent extroversion.

Word and letter spacing might be a good indicator of someone's demand for privacy. Wide spacing could be an indication of a drive for independence, whereas tight spacing might point to a restrained personality.

Handwriting slant (whether it leans to the left, right, or upright) is frequently related with emotional expressiveness. Right-leaning indicates extroversion, whereas left-leaning indicates introversion.

The amount of pressure used when writing might convey emotional intensity. Strong emotions may be indicated by heavy pressure, whilst sensitivity may be shown by gentle pressure.

Fast writers are frequently perceived as impatient or eager, whereas slow writers may be more deliberate and systematic.

Consistency of Letter Size: Consistent letter size may reflect attention to detail and precision, whereas variable size may imply a more creative or spontaneous personality.

Margins: How a person uses margins might provide information about their attitude to norms and structure. A person with small margins may feel limited, whereas a person with vast margins may feel liberated.

Letter Connections: Whether or not letters are connected can reveal a person's social nature. Letters that are connected may indicate a desire for connection and communication.

It should be noted that handwriting analysis, also known as graphology, is not regarded as a very reliable science. While some qualities may have broad connections, the interpretation is subjective, and it is not generally employed in professional psychological assessments. The field is more of an art than a science, so proceed with caution.

TECHNIQUES AND METHODOLOGIES

QUANTITATIVE ANALYSIS

Using statistical techniques to measure and compare various aspects of handwriting, such as the angles of specific letter formations or the proportions between different elements.

Likelihood Ratios: Applying statistical models to assess the likelihood that two handwriting samples come from the same individual, considering both similarities and differences.

Forensic document examination:

Ink and paper Analysis: Examining the properties of ink and paper, including chemical composition and physical characteristics, to provide additional context to handwriting analysis.

Indentation Analysis: Investigation indentations left on a surface due to pressure exerted during writing, which can be useful in reconstructing the sequence of written entries.

Technologies Automation:

Computerized Systems: Utilizing digital tools and software for image analysis, pattern recognition, and comparison aid forensic experts in their examination.

Digital Forensics: Examining electronically produced documents including those created using computers or other digital devices, and accessing their authenticity.

Challenges and Limitations:

Variability in Handwriting: Recognizing that an individual's handwriting can vary under different circumstances, introducing challenges making conclusive identifications.

Aging effects: Understanding how handwriting may change over time due to factors such as age, health, or environmental conditions.

IMPOTANCE IN CRIMINAL INVESTIGATIONS AND LEGAL PROCEEDINGS:

Handwriting examination plays a crucial role in criminal investigations and legal proceedings for several reasons:

Identification of Forgeries: Handwriting experts can determine whether a document, signature, or note is genuine or a forgery. This is vital in cases involving wills, contracts, checks, and other legal documents where the authenticity of signatures and content is disputed.

Authorship Attribution: Handwriting analysis can help identify the author of an anonymous or threatening letter,

ransom note, or graffiti, aiding in the apprehension of suspects in criminal investigations.

Dispute Resolution: In civil cases, handwriting examination can resolve disputes related to contested documents, ensuring fair outcomes in matters such as contested wills or disputed contracts.

Criminal Profiling: Handwriting experts can assist in profiling criminals by analyzing handwritten materials, helping law enforcement agencies narrow down their search for suspects based on writing style and characteristics.

Historical Document Analysis: In historical research, handwriting analysis can be used to authenticate or debunk historical documents and signatures, shedding light on important events and figures.

Expert Testimony: Handwriting experts often provide expert testimony in court to explain their findings, helping judges and juries make informed decisions.

Overall, handwriting examination is a valuable tool in forensic science that helps establish the authenticity of documents, identify individuals involved in criminal activities, and ensure justice in legal proceedings. Its importance lies in its ability to provide objective and scientific analysis in cases where the veracity of written materials is in question.

RECENT DEVELOPMENTS

Digital Forensics and signature recognition:

Integration of advanced digital forensic tools to analyze digitally produced documents and electronic signatures.

Application of machine learning and artificial intelligence in handwriting recognition to increase accuracy and efficiency.

Biometric Authentication:

Exploring handwriting biometrics as a method of personal identification and authentication integration of handwriting analysis with other biometric methods for comprehensive identity verification.

Advanced imaging techniques:

Implementation of high-resolution imaging techniques and 3D scanning for more detailed analysis of individual characteristics and subtle nuances in handwriting.

Innovations in Ink Analysis:

Advances in ink analysis, including the development of new techniques for identifying and characterizing ink.

Research on the aging effects of ink and the impact on handwriting analysis over time.

Cross-disciplinary research:

collaborate with other scientific disciplines such as linguistics and psychology to enhance understanding of the cognitive aspects of handwriting and its diversity.

Standardization and quality Assurance:

Continued efforts towards standardization of handwriting examination procedures and methods. Implementation of quality assurance measures to ensure reliability and reproducibility of forensic handwriting analysis.

Interdisciplinary Approaches:

Use of interdisciplinary approaches combining handwriting analysis with other forensic techniques for more comprehensive forensic document examination.

Ethical and legal considerations:

Research addressing ethical considerations in signature analysis, such as the limitations of expert testimony and potential impact on legal implications of emerging technologies in signature examination.

Training and education:

Development of advanced training programs and educational resources for forensic handwriting examiners to keep pace with technological advances and evolving methods.

International cooperation:

Increasing collaboration among forensic experts and researchers globally to share knowledge, methods and best practices in signature examination.

REVIEW LITERATURE

Patil, Manju Gouda (2019). Handwriting is distinct, and each person's writing style is distinct in its own manner. We may now state that handwriting is a resource of recorded data or information, and that following the modernizing period, languages are the indicating symbols for the system, with writing being the most essential aspect of it.

Hilton was born in 1956. Everyone has their own handwriting. It typically changes the range variation, but age also evaluates the deviation after the range of natural variation. As a result, if the examiners are unaware of this fact, they will notice variations in the results. Handwriting changes that beyond the range of natural variation are invariably the result of fabrication.

Mishra, Munish Kumar (2014) Handwriting samples from six different people from different years were investigated in this study, and the variations in handwriting, their types,

and the causes for their deviation beyond the range of variance were discussed based on the experiment results. It was discovered that the range of curvature in linked letters and the angle between linking strokes varies with age in all six situations.

Diana Harrison was born in the year 2009. Examiners look at the size and slope of the writing, pen pressure, pen lifts, the spacing between words and letters, the position of the writing on the baseline (the character's position in relation to the ruled or imaginary line), height relationships, and beginning and ending points.

Huber, RA, and AM Headrick (1999). Handwriting is a complicated motor skill involving sensory, neurological, and physiological signals. Visual perception and acuity, cognition of form, central nervous system pathways, and the architecture and physiology of the hand and arm's bones and muscles all work together to generate the intended result.

Kapoor and colleagues (1985) After ten years of investigation, the effect of handwriting happened. The spectrum of natural variation, rather than the features themselves, will evolve with time. The adjustments justify that handwriting comparisons remain less permanent.

Manpreet Kaur and Komal Saini (2019) Writing is a neuromuscular activity. The quality of an individual's handwriting/signatures can deteriorate significantly with age and disease. Due to poor line quality of handwriting, the impacted writings may be considered as forgery in some situations.

Monika Saini, A.K. Kapoor, and Vijit Deepani (2018) Background: Handwriting is a uniquely human attribute that advances and evolves throughout a person's life and fades with age. The purpose of this paper is to examine the variance in handwriting traits with age among female writers from various population groups in Delhi, India. Handwriting is a difficult talent that requires a writer's cognitive and motor control processing as well as visual-motor coordination. Handwriting improves and evolves as a trait over time.

S. Hus, B. Engel-Yeger, and S. Rosenblum (2012) Sensory-processing abilities in the elderly are known to decline. As a result, ordinary activities like handwriting may suffer. However, understanding of sensory-processing involvement in handwriting characteristics in older people is inadequate.

Srihari, S. N., et al. (2001) undertook a study to definitively validate the concept of handwriting identity. One hundred and five hundred handwritten samples of Us individuals were discovered in respect to gender, age,

ethnic background, and so on. Using computer methods to extract information from manuscript scanned images. The aim is to offer scientific evidence to support the use of handwritten evidence in court.

Nurten Turan and Faruk Aşıcıolu (2003) Directed an investigation to determine if handwriting changes while under the influence of alcohol, in order to establish the consistency of viewing explicit consequences. The preliminary was completed by 73 people who completed all procedures. When using booze, penmanship tests were administered. The test structure was examined using a stereomicroscope, direct and oblique angle lighting, and a video Spectral comparator (VSC 2000). Estimates were made using computerized caliper, ANOVA, and person relationship approaches. The findings revealed that handwriting criteria such as word lengths, upper- and lower-case letter stature, tallness of plunging letter, splitting between words, number of angularities, number of tremors, and number of tightened closes are mostly consistent.

CASE STUDIES

To identify offenders and verify document validity, expert forensic analysts meticulously evaluate people's traits at a microscopic level. Countless offenders have been accused, apprehended, and convicted using only a writing sample or a strand of hair, and the number will continue to rise.

Robert dusting

Robert Durst has been suspected of murdering Susan Berman since her death in 2000. However, there is no physical evidence connecting him to this case. Durst's old friend Batman was found dead with a gunshot wound to the back of the skull. However, communications between the two indicated that they did not have the best of connections.

A handwritten letter addressed to Berman in 1999 is among the evidence against Durst. The letter's text matched an anonymous note given to Beverly Hills police at the time of Berman's murder, which used the identical block form language with all capital characters. He not only gave police information that the killer knew, but he also used the identical misspelling of Beverly Hills: "Beverly Hills."

BTK assassin

For nearly two decades, Dennis Rader, also known as BTK ("Bind, Torture, kill"), terrorized the Wichita, Kansas area. Rader was not even suspected of torturing ten known victims between 1974 and 1991 until nearly fifteen years after his final victim was murdered.

Rader became the top suspect in the BTK case in 2005, when there were no leads. This is due to the fact that he then began a series of interactions with the media.

Although the ace in the hole was looking for contact information for the prosecution, Rader unwittingly provided the police with contact information on a computer floppy disc, which they were able to forensically match a series of handwritten letters once found. These were the handwritten notes he submitted to the police in order to communicate, garner media attention, and strike dread into the minds of people. This desire for public attention, along with his ignorance, eventually did him in.

To identify offenders and verify document validity, expert forensic analysts thoroughly evaluate individual traits at a microscopic level. Countless offenders have been accused, apprehended, and convicted using only a writing sample or a strand of hair, and the number will continue to rise.

CONCLUSION

Handwriting analysis is still an important instrument in forensic science and is used in many parts of criminal investigation and legal proceedings. The review article goes into the history, scientific foundations, and methodologies of handwriting analysis, emphasizing its unique and ongoing significance. The neuromuscular coordination associated with handwriting distinguishes each person's writing style, akin to fingerprints, and its uniqueness serves as the foundation for forensic analysis.

The division of handwriting characters into classes and individual characters, as well as characters such as terminal stroke, diacritics, and others, emphasizes the complexities of handwriting analysis. A thorough evaluation of classroom characteristics such as alignment, spacing, slope, and movement aids in gaining a thorough comprehension of the discipline.

The case studies given, which involve people like Robert Durst and the BTK killer, show how handwriting analysis can be used to solve criminal cases. These examples demonstrate how skilled forensic analysts can use handwriting analysis to identify, apprehend, and convict offenders.

While technology progresses and digital data forensic analysis gains importance, handwriting analysis remains an indispensable and beneficial forensic science. His capacity to provide impartial and scientific analysis in written evidence situations maintains his continuous significance in modern forensic investigations.

The field of handwriting analysis may confront hurdles in the future, and continuous study will most likely refine and

improve the methodologies. However, its distinct significance in authenticating documents, investigating crimes, and contributing to the field's importance of handwriting analysis.

REFERENCE

- 1) Manju Gouda Patil 2019 Research Scholar Authors Effect of Age on Handwriting-A Analytical Study.
- 2) O. Hilton, "Influence of age and illness on handwriting: Identification problems," *Forensic Science*, 9, pp. 161-172, 1977. You can find it at: [https://doi.org/10.1016/0300-9432\(77\)90087-5](https://doi.org/10.1016/0300-9432(77)90087-5).
- 3) Munish Kumar Mishra 3) 2014 Age Effect on Handwriting Research Gate
- 4) Huber RA, Headrick AM (1999) *Handwriting identification: facts and fundamentals*. CRC Press. USA'
- 5) Danielle P. Seiger, Ted M. Burkes, and Diana Harrison. 2009 *Handwriting examination: meeting scientific and legal challenges*
- 6) *Handwriting identification: facts and fundamentals*, Huber RA, Headrick AM (1999). USA: CRC Press'
- 7) *Forensic handwriting and signature analysis* by Meredith Dekalb Miller. Accessible at: <https://dekalbmiller.com/forensic-handwriting-analysis/>
- 8) 2020: Khushboo, Divya Bajpai Tripathy, and Vinay Singh A Review of Handwriting Examination on Unusual Surfaces.
- 9) Rosenblum, S., Engel-Yeger, B., and Fogel, Y. (2013) Changes in executive control with age and their consequences and their relationships with activity performance in handwriting. *Hum Mov Sci* 32: 1056-69
- 10) Kapoor. S., Kapoor, M., Sharma, G.M. (1985), "age effect on handwriting" *Journal of forensic society* Volume 25 issue-5, September. pp. 371-375.
- 11) Komal Saini and Manpreet Kaur (2019) Forensic study on the effect of age and illness (Parkinsonism) on handwriting characteristics.
- 12) Vijit Deepani, A.K. Kapoor, and Monika Saini (2018) Age Related Variation in Feminine Handwriting among Population Groups of Delhi, India
- 13) B. Engel-Yeger, S. Hus, and S. Rosenblum, "Age effects on sensory-processing abilities and their impact on handwriting," *Canadian Journal of Occupational Therapy*, vol. 79, no. 5, pp. 264-274, 2012. View at: Publisher Site | Google Scholar
- 14) R. Plamondon, C. O'Reilly, C. Remi, and T. Duval, "The lognormal hand writer: learning, performing, and declining," *Frontiers in Psychology*, vol. 4, article 945, 2013.view at: Publisher Site | Google Scholar
- 15) F. Hole Kian, "Handwriting analysis: the role of age and education," *International Journal of Modern Management and Foresight*, vol. 1, no. 6, pp. 208-221, 2014.
- 16) N. Van Drempt, A. McCluskey, and N. A. Lannin, "Handwriting in healthy people aged 65 years and over," *Australian Occupational Therapy Journal*, vol. 58, no. 4, pp. 276-286, 2011.

- 17) T. Nataraja Moorthy, M. M. B. A. Sultan, and W. K. Yong, "A study on the age-related retention of individual characteristics in hand writings and signatures for application during forensic investigation," *Malaysian Journal of Forensic Sciences*, vol. 1, no. 1, pp. 55–60, 2010.
- 18) S. Al Maadeed and A. Hassaine, "Automatic Prediction of Age, Gender," and Nationality in Offline Handwriting, *EURASIP Journal on Image and Video Processing*, vol. 1, p. 10, 2014.
- 19) Srihari, S. N., Cha, S.-H., Arora, H., & Lee, S. (2001). Individuality of Handwriting. *Journal of Forensic Sciences*. 47: 1-17.
- 20) Faruk Aşicioğlu, Nurten Turan (2003) Handwriting changes under the effect of alcohol
- 21) Graham, S. and Weintraub, N., 1996. A review of handwriting research: Progress and prospects from 1980 to 1994. *Educational Psychology Review*, 8(1), pp, 7-87.